UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Sistemi Complessi: Modelli e Simulazione

2122-2-F9201P035

Aims

Students will learn new models, abstractions and mechanisms for the modeling of complex systems but also practical tools for the design and development of systems (not exclusively aimed at the simulation of complex systems) based on an agent-based approach.

Contents

This course aims at introducing conceptual and computational models and instruments developed in the contexts of the Sciences of Complexity and Distributed Artificial Intelligence supporting simulation of complex systems or the design of systems characterized by the presence of autonomous interacting components (agents). Cellular Automata and multi-agent system models are growingly diffused in the study of complex systems (such as biological, socioeconomic systems), but they also represent useful abstractions and mechanisms for the design of distributed computer systems (e.g. monitoring and control systems, smart environments, computer supported cooperative work systems, advanced web applications).

Detailed program

1. Introduction to the concepts of agent and multi-agent system (from single intelligent agent to a multi-agent system, agent architectures, agent interaction models, agents and environments)

2. Cellular Automata and complex systems modeling: complex vs. complicated systems, 1D and 2D cellular automata and their application to paradigmatic case studies (traffic and population dynamics)

3. From cellular automata to multi-agent systems: agent-based modeling and simulation of crowds of pedestrians; social simulation; integration of heterogeneous approaches; additional case studies

4. Deliberative agents: cognitive agents and metal states; notion of deliberation; examples of deliberative agent models, languages and tools

5. Applications of agent based and multi-agent systems: advanced web applications; computer supported cooperative work in the pervasive computing context; reactive agents and smart environments

Prerequisites

None. Basic computer programming proficiency could be useful to implement the project required for the final assessment.

Teaching form

Theoretical and methodological aspects will be presented along with practical examples and case studies, employed to exemplify the introduced topics; specific tools for the realization of simulators based on presented models and approaches will be presented; suitable references to the relevant and recent scientific literature will be given for supporting an in depth study of the treated topics. The course is in Italian although the teaching material is in English.

The 2020/21 edition was held from remote (recorded lessons and some "live" lessons, held via teleconference systems, and however also recorded), we foresee that the 2021/22 edition will be traditional (in presence), but any change will depend on the state of the COVID-19 outbreak.

Textbook and teaching resource

Text book (for point 1 of the detailed course program): Multi-Agent System: An Introduction to Distributed Artificial Intelligence. Jacques Ferber, Harlow: Addison Wesley Longman, 1999, ISBN 0-201-36048-9

Additional teaching material: slides made available through the eLearning platform and links to scientific papers.

Semester

Second semester.

Assessment method

The learning assignments are essentially related to the production of an essay related to the introduced topics, that implies the realization of a project (a practical implementation and experimentation of prototypical simulator) and its discussion in an oral exam that concerns all the topics introduced throughout the course.

The topic of the essay and project is typically agreed upon with the instructor, even during the course; the instructor provides an assessment of the adequacy and level of difficulty of the proposed work, and he proposes indications for the organization of work.

Office hours

Wednesday from 9:30 to 11:30 or other days/times always by appointment, potentially also via teleconferencing systems.